Installation Manual
P/N 20002158, Rev. A
September 2005

Micro Motion® ELITE® Sensors

Installation Manual

Micro Motion®
EMERSON™ Process Management

Before You Begin

This manual describes how to install a Micro Motion® ELITE® sensor. The following information is provided in this manual:

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Customer service

For technical assistance, phone the Micro Motion Customer Service Department:

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277)
- In Canada and Latin America, phone (303) 527-5200
- In Asia, phone (65) 6770-8155
- In the U.K., phone 0800 - 966 180 (toll free)
- Outside the U.K., phone +31 (0) 318 495 670

Troubleshooting

Refer to the transmitter manual for troubleshooting help.

Specifications

Full product specifications can be found in the ELITE Product Data Sheet, which is available from the Micro Motion web site at **www.micromotion.com**.

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Definitions

The term *MVD™ transmitter* refers to the following transmitter models:

- Models 1500, 1700, 2400S, 2500, and 2700
- Models 3500 and 3700

European installations

This Micro Motion product complies with all applicable European directives when properly installed in accordance with the instructions in this manual. Refer to the EC declaration of conformity for directives that apply to this product.

The EC declaration of conformity, with all applicable European directives, and the complete *ATEX Installation Drawings and Instructions* are available on the internet at **www.micromotion.com/atex** or through your local Micro Motion support center.

Information affixed to equipment that complies with the Pressure Equipment Directive can be found on the internet at **www.micromotion.com/library**.

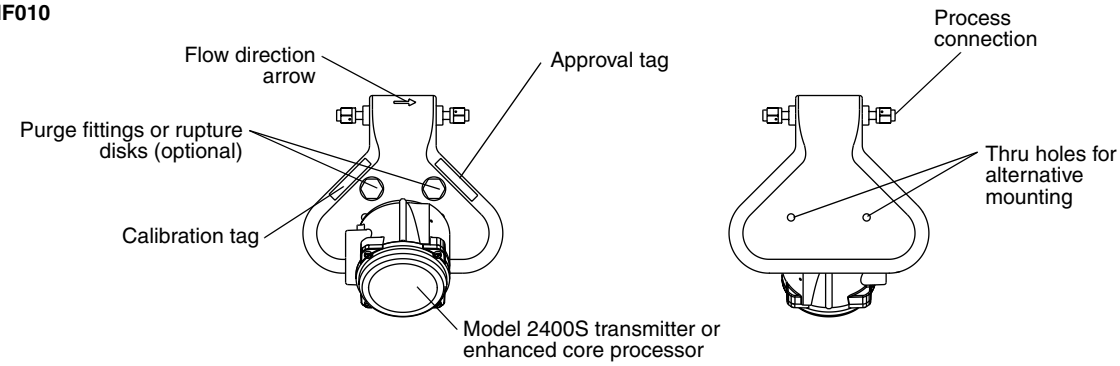
Installation options

The ELITE sensor makes up one part of a Coriolis flowmeter. The other part is a transmitter. ELITE sensors are available with the following electronics interfaces:

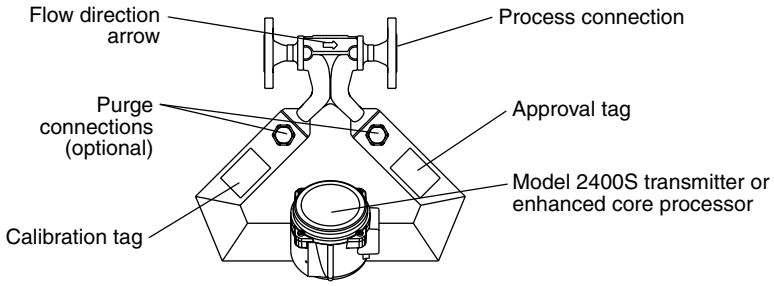
- An integral Model 2400S transmitter or enhanced core processor (see Figure 1).
- An integral core processor for connecting to a 4-wire remotely mounted transmitter or to a user-supplied remote host (see Figure 2).
- A 9-wire junction box for connecting to a remotely mounted transmitter or a remotely mounted core processor (see Figure 3).
- Models CMF100A, CMF200A, CMF300A, and CMF400A are equipped with a flexible conduit, on which can be mounted a Model 2400S transmitter, a Model 1700/2700 transmitter, a core processor, or a junction box (see Figures 4 and 5).

Figure 1 ELITE sensor with Model 2400S transmitter or enhanced core processor

CMF010



CMF025, CMF050, or CMF100



CMF200, CMF300, or CMF400

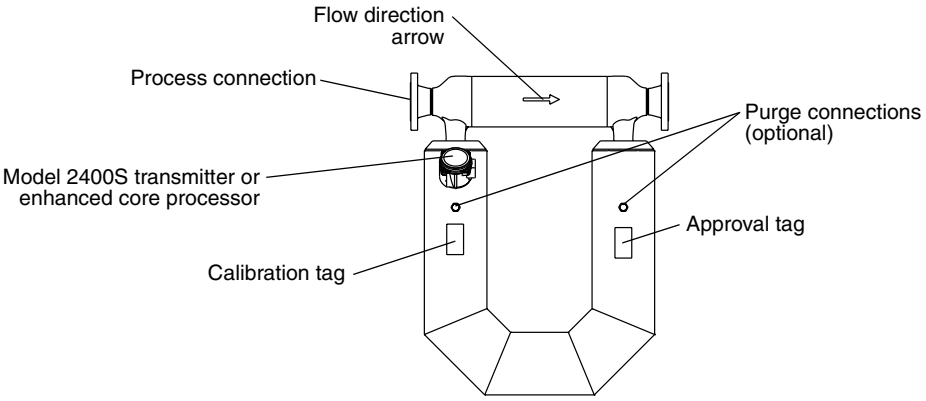
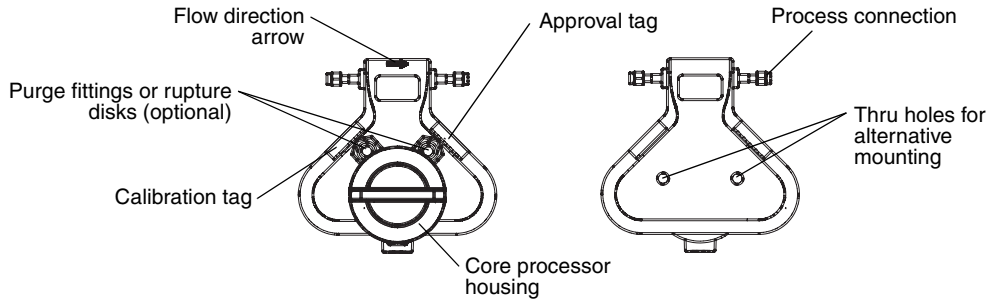
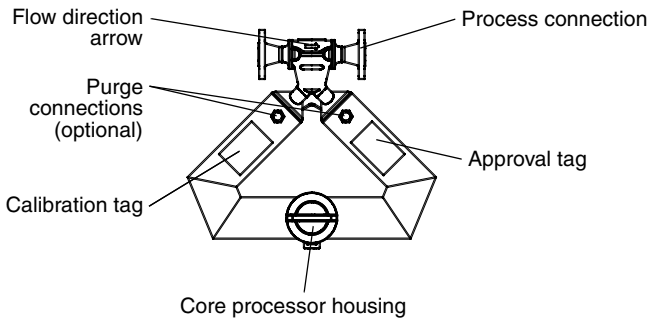


Figure 2 ELITE sensor with core processor

CMF010



CMF025, CMF050, or CMF100



CMF200, CMF300, or CMF400

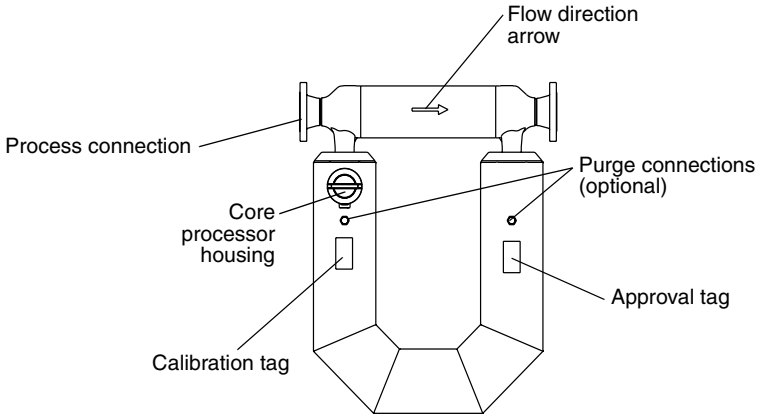
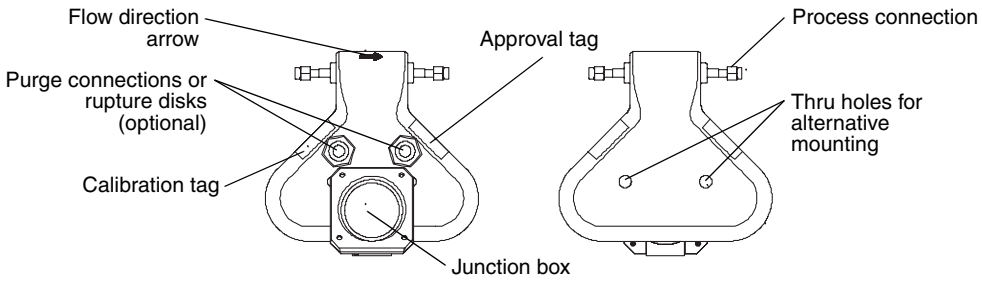
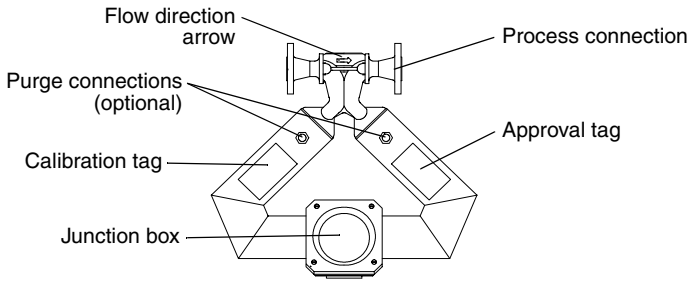


Figure 3 ELITE sensor with junction box

CMF010



CMF025, CMF050, or CMF100



CMF200, CMF300, or CMF400

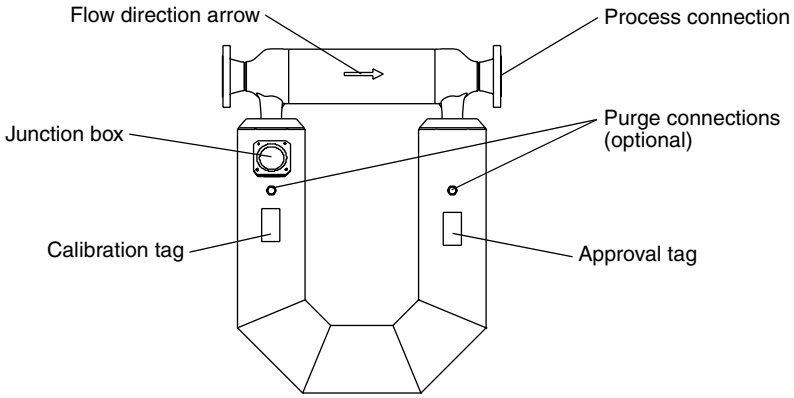


Figure 4 Model CMF100A sensor

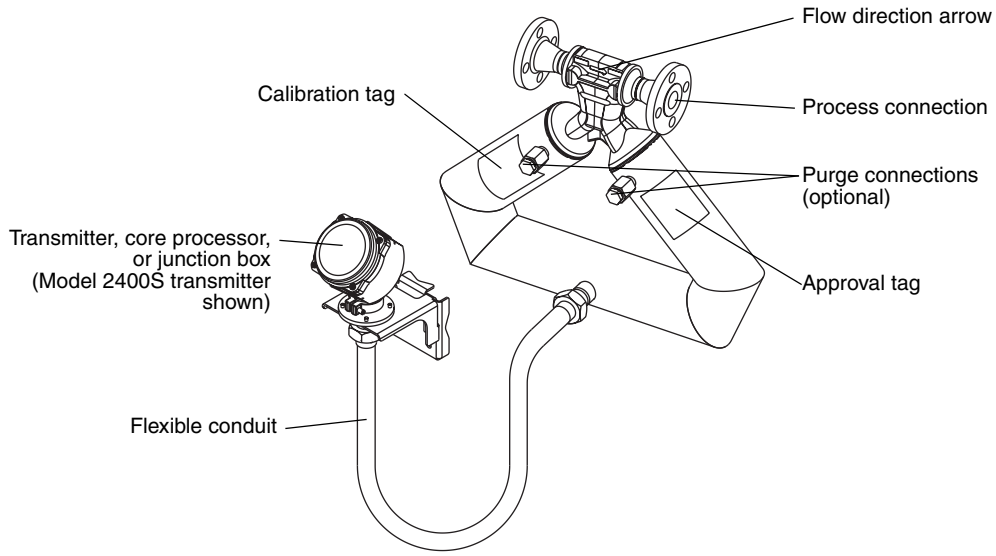
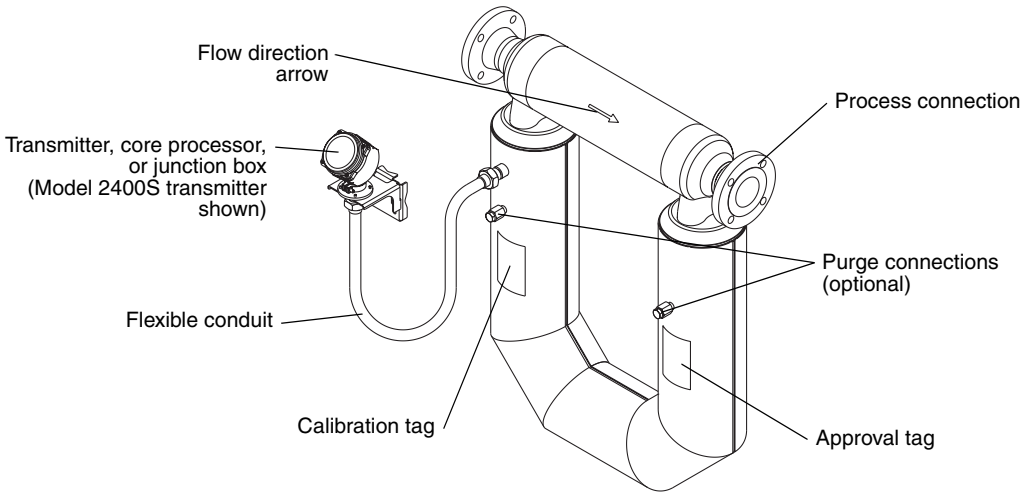


Figure 5 CMF200A, CMF300A, or CMF400A sensor



Step 1 Determining a Location

Choose a location for the sensor based on the requirements described in this section. The following general guidelines can help you select an appropriate location for the sensor.

- For optimal performance, the sensor should remain full of process fluid.
- The sensor must be installed in an area that is compatible with the classification specified on the approval tag (see Figures 1–5).

Hazardous area installations

Make sure the hazardous area specified on the sensor approval tag is suitable for the environment in which the sensor is installed. (See Figures 1–5.) For installation in an area that requires intrinsic safety, refer to the appropriate Micro Motion approval documentation, shipped with the sensor or available from the Micro Motion web site at **www.micromotion.com**.

⚠ WARNING

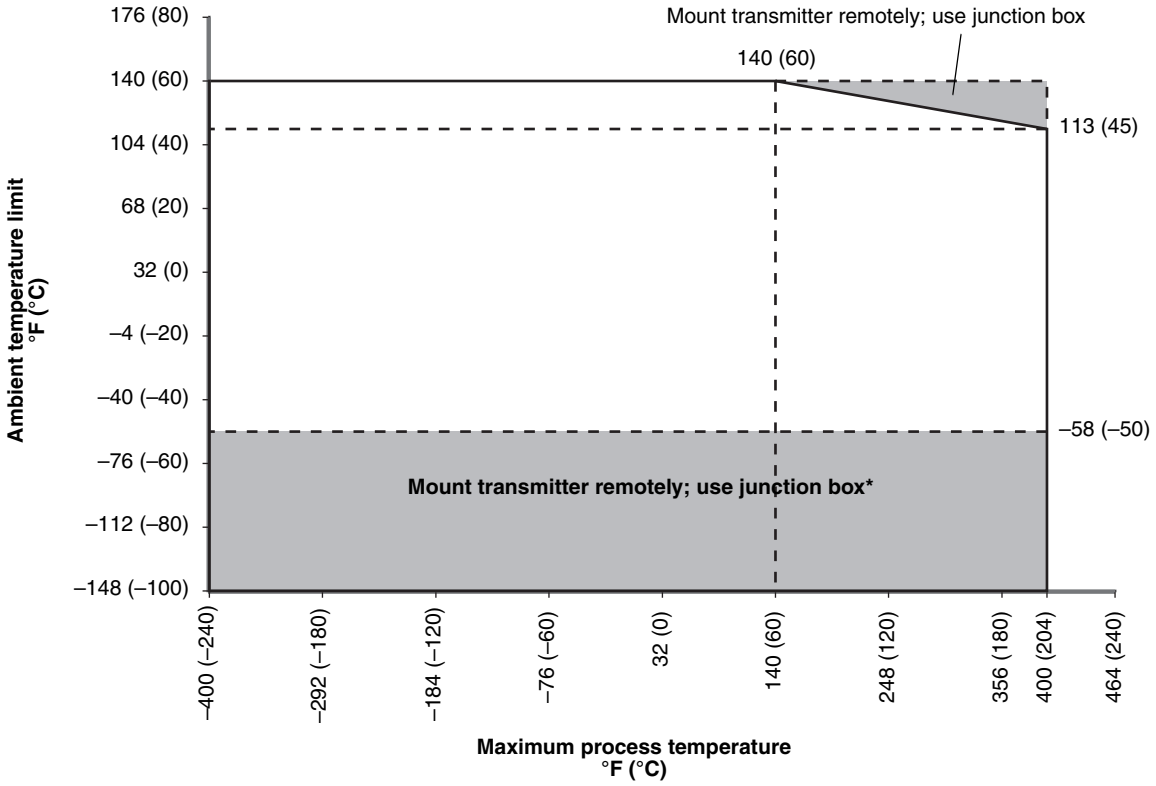
Failure to comply with requirements for intrinsic safety in a hazardous area could result in an explosion.

- Make sure the hazardous area specified on the sensor approval tag (Figures 1–5) is suitable for the environment in which the sensor will be installed.
- For installations in an area that requires intrinsic safety, use this document along with Micro Motion approval documentation, shipped with the sensor or available on the Micro Motion web site at **www.micromotion.com**.
- For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

Environmental limits

The ambient and process temperature limits of the sensor are shown in Figure 6.

Figure 6 ELITE ambient and process temperature limits



* *When ambient temperature is below –58 °F (–50 °C), a core processor or Model 2400S transmitter must be heated to bring its local ambient temperature to between –58 °F (–50 °C) and +140 °F (+60 °C). Long-term storage of electronics at ambient temperatures below –58 °F (–50 °C) is not recommended.*

Hazardous area approvals may impose additional limits on ambient and process temperature. For the ATEX "T" rating, refer to the ATEX documentation shipped with the sensor or available on the Micro Motion web site at **www.micromotion.com**. UL, CSA, and IECEx ambient temperature limits are listed in Table 1.

Table 1 UL, CSA, and IECEx ambient temperature limits

	Sensor models	Electronics	°F	°C
UL	All models	Junction box	+104 maximum	+40 maximum
		Core processor	–40 to +104	–40 to +40
CSA	All models	Junction box	+140 maximum	+60 maximum
		Core processor	–40 to +140	–40 to +60
	All models except CMF400	2400S transmitter	–40 to +140	–40 to +60
	CMF400	2400S transmitter	–58 to +140	–50 to +60
IECEx	All models	Junction box	–4 to +131	–20 to +55
		Core processor	–4 to +131	–20 to +55
	All models except CMF400	2400S transmitter	–4 to +131	–20 to +55
	CMF400	2400S transmitter	–40 to +131	–40 to +55

Maximum wiring distances

The maximum distance between the sensor and transmitter depends on cable type. See Table 2.

Table 2 Maximum cable lengths

Cable type	Wire size	Maximum length
Micro Motion 9-wire to an MVD transmitter or core processor	Not applicable	60 feet (20 meters)
Micro Motion 9-wire to all other transmitters	Not applicable	1000 feet (300 meters)
Micro Motion 4-wire	Not applicable	1000 feet (300 meters)
User-supplied 4-wire		
Power wires (VDC)	22 AWG (0,35 mm^2)	300 feet (90 meters)
	20 AWG (0,5 mm^2)	500 feet (150 meters)
	18 AWG (0,8 mm^2)	1000 feet (300 meters)
Signal wires (RS-485)	22 AWG (0,35 mm^2) or larger	1000 feet (300 meters)

Pipe run

Micro Motion sensors do not require a straight run of pipe upstream or downstream.

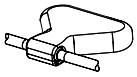
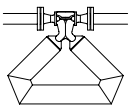
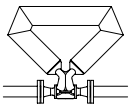
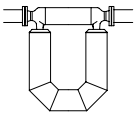
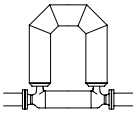
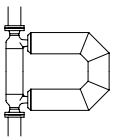
Valves

Meter zero can be adjusted for special circumstances. When zeroing is performed with the auto-zero feature of the transmitter, it is necessary to halt flow through the sensor, with the sensor tubes full of process fluid at typical process conditions. The valve used to halt flow in this situation should be downstream from the sensor. It is also possible to restore the meter's factory zero setting. For more information about zeroing, refer to the instruction manual shipped with the transmitter.

Step 2 Orienting the Sensor

The sensor will function properly in any orientation if the sensor tubes remain filled with process fluid. Micro Motion recommends orienting ELITE sensors as shown in Table 3.

Table 3 Recommended sensor orientations

Sensor model	Application	Recommended orientation	
CMF010	All applications	Tubes flat Horizontal pipeline	
CMF025, CMF050, and CMF100	Liquids	Tubes down Horizontal pipeline	
	Gases and slurries	Tubes up Horizontal pipeline	
CMF200, CMF300, and CMF400	Liquids	Tubes down Horizontal pipeline	
	Gases	Tubes up Horizontal pipeline	
	Slurries	Flag mount Vertical pipeline	

Flow direction arrow

The sensor has a flow direction arrow (see Figures 1–5) to help you configure the transmitter for flow direction. If possible, install the sensor so that the flow direction arrow matches actual process flow.

Vertical pipeline

If the sensor is installed in a vertical pipeline, liquids and slurries should flow upward through the sensor. Gases may flow upward or downward.

Step 3 Mounting the Sensor

Figure 7 illustrates how to mount the sensor. The CMF010 sensor has an optional mounting configuration (Figure 8) for use with small or soft pipeline. To reduce the risk of condensation or excessive moisture, the conduit opening should not point upward (if possible). The conduit opening of the junction box or core processor can be rotated freely to facilitate wiring.

Figure 7 Mounting an ELITE sensor

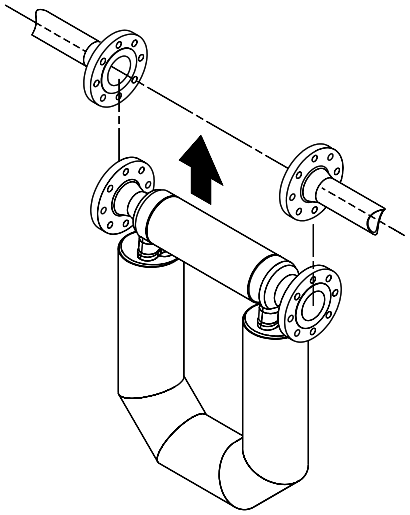
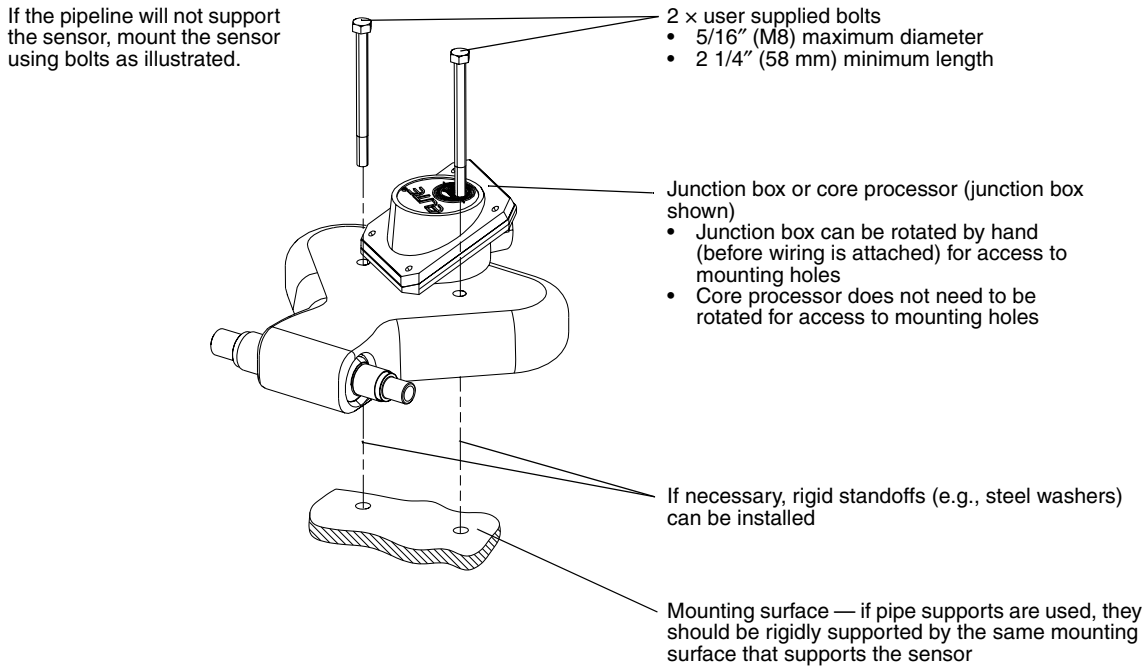


Figure 8 Optional mounting for CMF010 sensors

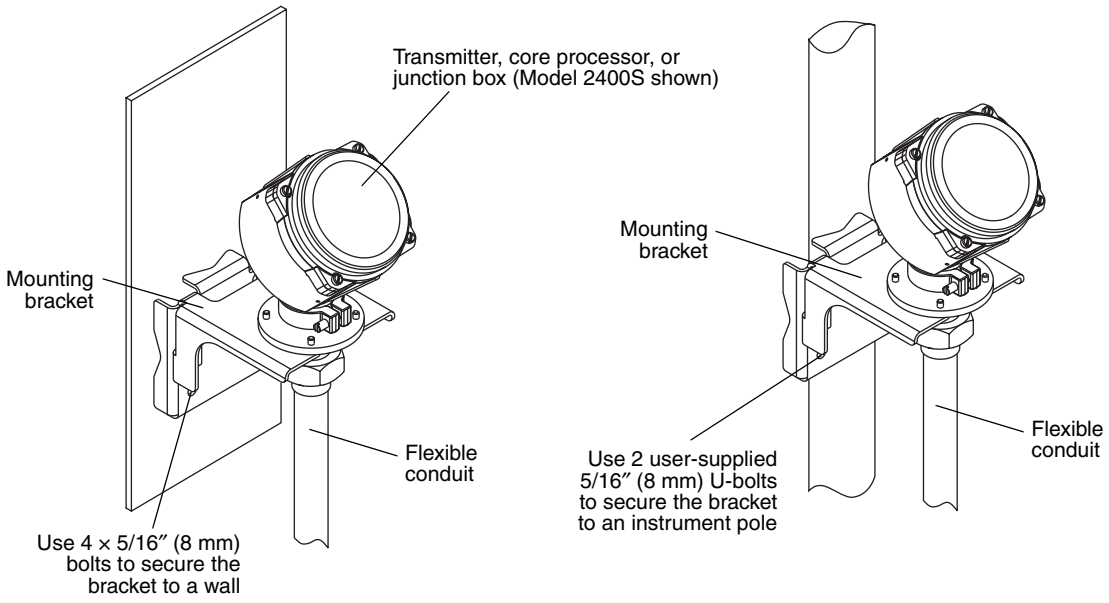

If the pipeline will not support the sensor, mount the sensor using bolts as illustrated.
2 × user supplied bolts
• 5/16″ (M8) maximum diameter
• 2 1/4″ (58 mm) minimum length
Junction box or core processor (junction box shown)
• Junction box can be rotated by hand (before wiring is attached) for access to mounting holes
• Core processor does not need to be rotated for access to mounting holes
If necessary, rigid standoffs (e.g., steel washers) can be installed
Mounting surface — if pipe supports are used, they should be rigidly supported by the same mounting surface that supports the sensor

Mounting the electronics of high-temperature sensors

Model CMF100A, CMF200A, CMF300A, and CMF400A sensors come with a 32″ (812 mm) pre-installed flexible conduit. This conduit is required for agency approval.

A factory-supplied Model 2400S transmitter, Model 1700/2700 transmitter, core processor, or junction box is connected to the end of the flexible conduit. Mount the electronics to a wall or instrument pole using the supplied bracket (Figure 9).

Figure 9 Electronics mounting for Models CMF100A, CMF200A, CMF300A, and CMF400A sensors


Transmitter, core processor, or junction box (Model 2400S shown)
Mounting bracket
Flexible conduit
Use 4 × 5/16″ (8 mm) bolts to secure the bracket to a wall
Mounting bracket
Flexible conduit
Use 2 user-supplied 5/16″ (8 mm) U-bolts to secure the bracket to an instrument pole

Installing wafer-style sensors

A wafer-style sensor, which has no flanges or fittings, lets you "clamp" the sensor between process connections in the pipeline. Model CMF025, CMF050, and CMF100 sensors are available in the wafer style.

A wafer installation kit is shipped with a wafer-style sensor. A wafer kit contains the following pieces:

- 4 flange bolts
- 8 flange nuts
- 2 alignment rings, which help center the sensor between the bolts

To install a wafer-type sensor, refer to Figures 10 and 11 and follow the steps below:

1. Make sure the bolts provided in the wafer installation kit are rated for your process connection.
2. Slip the sensor alignment rings over each end of the sensor wafer, then insert the sensor between the process connections in the pipeline (Figure 10). Installing gaskets is recommended. (Micro Motion does not supply gaskets.)
3. Insert the bolts through both process connections, and thread the nuts onto the bolts. Tighten nuts as tight as you can with your fingers.
4. Rotate the sensor alignment rings in the direction that pushes the bolts outward (Figure 11). Rotate both rings until the assembly is centered and tight.
5. With a wrench, tighten nuts in an alternating order, to ensure the process connections are evenly tightened.

Figure 10 Wafer-style assembly

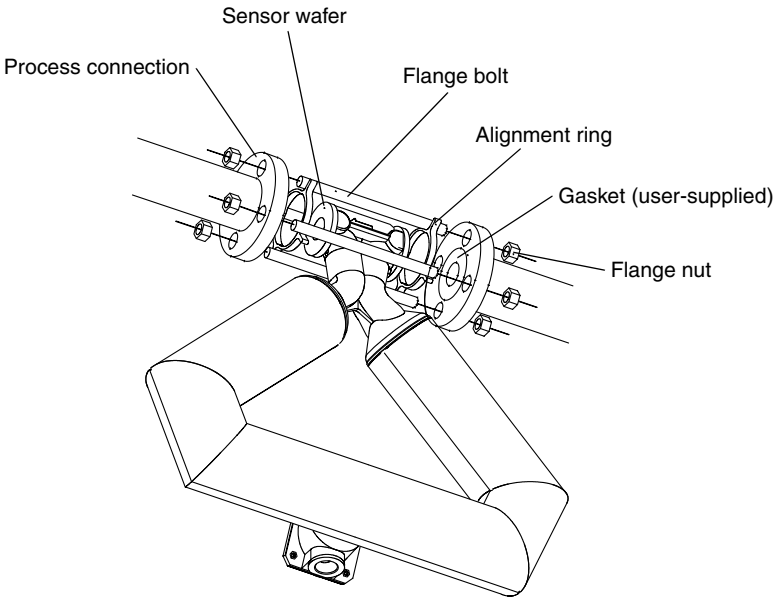
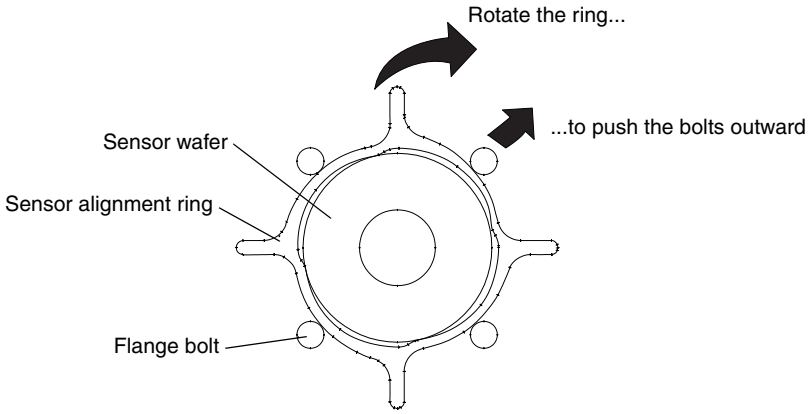


Figure 11 Tightening the sensor alignment rings



Step 4 Wiring

Hazardous area installations

If you are installing the sensor in a hazardous location, verify that the hazardous classification information printed on the sensor tag matches the environment in which the sensor will be installed.

⚠ WARNING

Failure to comply with the requirements for intrinsic safety in a hazardous area could result in an explosion.

- Make sure the hazardous area specified on the sensor approval tag (Figures 1–5) is suitable for the environment in which the sensor will be installed.
- For installations in an area that requires intrinsic safety, use this document along with Micro Motion approval documentation, shipped with the sensor or available on the Micro Motion web site at **www.micromotion.com**.
- For hazardous installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

⚠ CAUTION

Failure to seal the sensor and transmitter housings could cause electronics to be exposed to moisture, which could result in measurement error or flowmeter failure.

- Close and fully tighten all covers.
- Ensure the integrity of gaskets and O-rings.
- Grease all O-rings before sealing.
- Install drip legs in cable or conduit.
- Seal all conduit openings.

Installation options

The sensor has one of the following configurations:

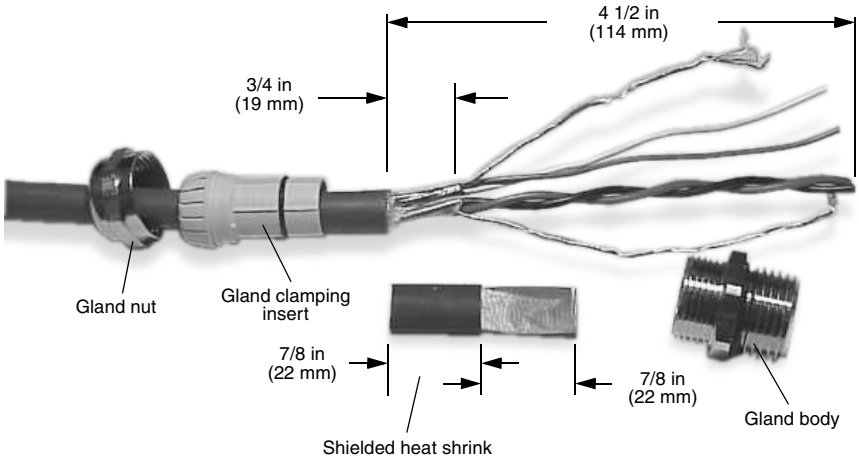
- An integral Model 2400S (all models) or Model 1700/2700 transmitter (high-temperature models only). No wiring is required between the sensor and the transmitter. Skip to *Grounding* on page 18.
- A core processor to a 4-wire remote transmitter (requires 4-wire cable); see *Core processor to a 4-wire remote transmitter* on page 15.
- A core processor to a remote host (requires 4-wire cable); refer to the *Micro Motion MVD™ Direct Connect™ Meters Installation Manual*.
- A junction box to a 9-wire remote transmitter or remote core processor (requires 9-wire cable); see *Junction box to a 9-wire remote transmitter or remote core processor* on page 18.

Core processor to a 4-wire remote transmitter

Follow the steps below to connect the 4-wire cable between the core processor and the transmitter.

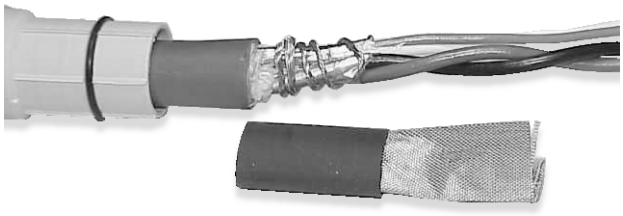
1. Use one of the following methods to shield the wiring from the core processor to the transmitter:
   - If you are installing unshielded wiring in continuous metallic conduit that provides 360° termination shielding for the enclosed wiring, go to page 17 (step 6 of the wiring procedure).
   - If you are installing a user-supplied cable gland with shielded cable or armored cable, terminate the shields in the cable gland. Terminate both the armored braid and the shield drain wires in the cable gland. Never connect the drain wires to the internal ground screw of the core processor. Go to page 17 (step 6 of the wiring procedure).
   - If you are installing a Micro Motion-supplied cable gland at the core processor housing:
     - Prepare the cable and apply shielded heat shrink as described below. The shielded heat shrink provides a shield termination suitable for use in the gland when using cable whose shield consists of foil and not a braid. Proceed to step 2 of the wiring procedure, below.
     - With armored cable, where the shield consists of braid, prepare the cable as described below, but do not apply heat shrink. Proceed to step 2 of the wiring procedure, below.
2. Remove the cover from the core processor housing.
3. Slide the gland nut and the clamping insert over the cable.

Figure 12 Micro Motion cable gland and heat shrink



4. For connection at the core processor housing, prepare shielded cable as follows (for armored cable, omit steps d, e, f, and g):
   a. Strip 4 1/2 inches (114 mm) of cable jacket.
   b. Remove the clear wrap that is inside the cable jacket, and remove the filler material between the wires.
   c. Remove the foil shield that is around the insulated wires, leaving 3/4 inch (19 mm) of foil or braid and drain wires exposed, and separate the wires.
   d. Wrap the shield drain wire(s) around the exposed foil twice. Cut off the excess wire.

Figure 13 Wrapping the shield drain wires

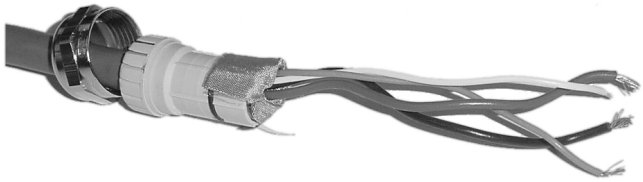


e. Place the shielded heat shrink over the exposed shield drain wire(s). The tubing should completely cover the drain wires.
f. Without burning the cable, apply heat (250 °F or 120 °C) to shrink the tubing.

Figure 14 Applying the heat shrink

g. Position gland clamping insert so the interior end is flush with the heat shrink.
h. Fold the cloth shield or braid and drain wires over the clamping insert and approximately 1/8 inch (3 mm) past the O-ring.

Figure 15 Folding the cloth shield

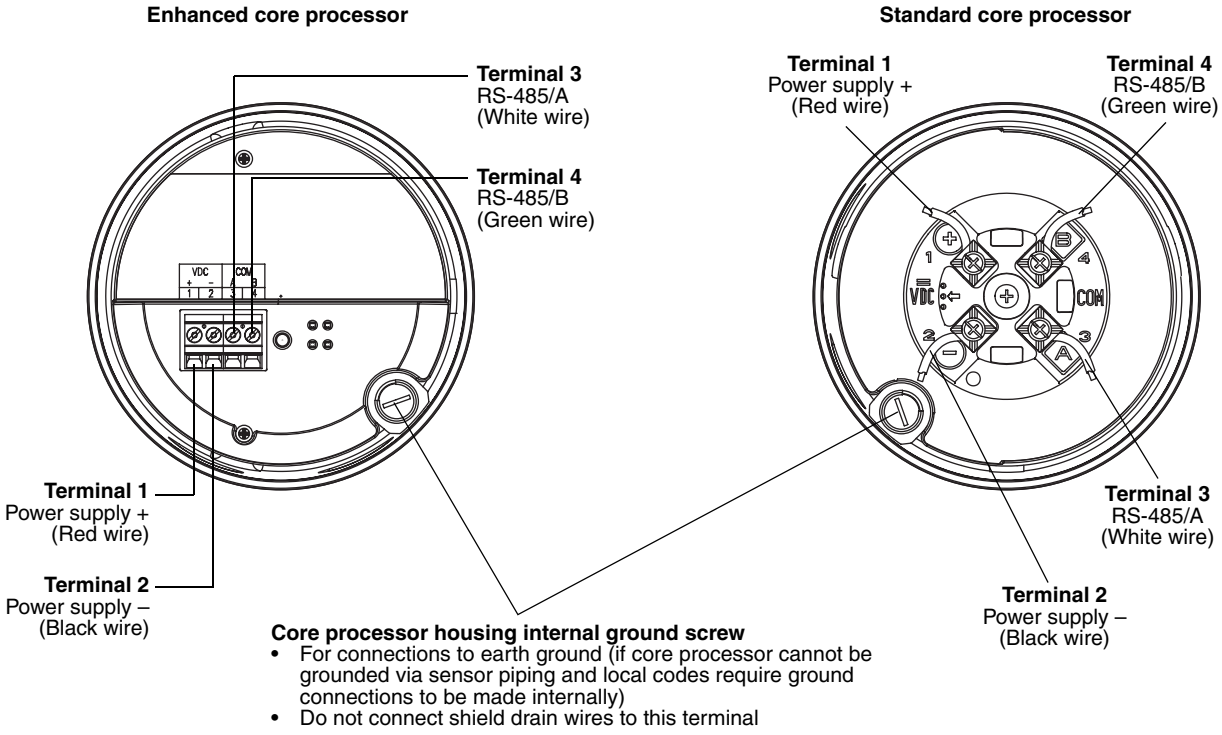


i. Install the gland body into the core processor housing conduit opening.

Figure 16 Gland body and core processor housing

5. Insert the wires through the gland body and assemble the gland by tightening the gland nut. If desired, leave sufficient wire length inside the core processor housing to allow the housing to rotate without damaging the wires.
6. Identify the wires in the 4-wire cable. The 4-wire cable supplied by Micro Motion consists of one pair of 18 AWG (0,80 mm^2) wires (red and black), which should be used for the VDC connection, and one pair of 22 AWG (0,35 mm^2) wire (green and white), which should be used for the RS-485 connection. Connect the four wires to the numbered slots on the core processor (Figure 17).

Figure 17 Connecting the wires at the core processor



7. Reinstall and tighten the core processor housing cover.
8. Additional wiring instructions for the transmitter can be found in the transmitter manual.

   Note: Never ground the 4-wire cable shield and shield drain wire(s) at the transmitter.

Junction box to a 9-wire remote transmitter or remote core processor

Follow the steps below to connect the 9-wire cable between the sensor and the transmitter or core processor.

1. Prepare and install the cable according to the instructions in Micro Motion's *9-Wire Flowmeter Cable Preparation and Installation Guide*.
2. Insert the stripped ends of the individual wires into the terminal blocks. No bare wires should remain exposed.
3. Match the wires color for color. For wiring at the transmitter or remote core processor, refer to the transmitter documentation.
4. Tighten the screws to hold the wires in place.
5. Ensure integrity of gaskets, then tightly close and seal the junction box cover and all housing covers on the transmitter or core processor.

Step 5 Grounding

The sensor can be grounded via the piping if the joints in the pipeline are ground-bonded. If the sensor is not grounded via the piping, connect a ground wire to the internal or external grounding screw, which is located on the transmitter, core processor, or junction box.

⚠ CAUTION

Improper grounding could cause measurement error.

To reduce the risk of measurement error:

- Ground the flowmeter to earth, or follow ground network requirements for the facility.
- For installation in an area that requires intrinsic safety, refer to the appropriate Micro Motion approval documentation, shipped with the sensor or available from the Micro Motion web site.
- For hazardous area installations in Europe, refer to standard EN 60079-14 if national standards do not apply.

If national standards are not in effect, follow these guidelines to ground the sensor:

- Use copper wire, 14 AWG (2,0 mm²) or larger wire size for grounding.
- Keep all ground leads as short as possible, less than 1 ohm impedance.
- Connect ground leads directly to earth, or follow plant standards.

Purge Fittings

If the sensor has purge fittings, they should remain sealed at all times. After a purge plug has been removed, the sensor case should be purged with argon or nitrogen and resealed.

Purging the case protects internal components. The sensor is purged of all oxygen and sealed at the factory. If the purge plugs are never removed, it is not necessary to purge or re-seal the sensor. For more information, contact Micro Motion Customer Service.

Removing a purge plug

If a purge plug is removed from the sensor case, it will be necessary to repurge the case.

⚠ WARNING

Removing a purge plug compromises the secondary containment of the sensor and could expose the user to process fluid.

The user should take all necessary precautions when removing the purge plugs, because the sensor case may contain process fluid.

⚠ WARNING

Improper pressurization of a sensor case could result in serious personal injury.

Removing a purge plug will require the sensor case to be repurged with a dry inert gas. Follow all instructions provided in the case purging procedure, below.

Case purging procedure

Read all instructions before performing the case purging procedure. It is not necessary to perform this procedure unless a purge plug has been removed.

1. Shut down the process, or set control devices for manual operation.

⚠ CAUTION

Performing the purge procedure while the flowmeter is operating could affect measurement accuracy, resulting in inaccurate flow signals.

Before performing the case purging procedure, shut down the process, or set control devices for manual operation.

2. Remove both purge plugs from the sensor case. If purge lines are being used, open the valve in the purge lines.
3. Prepare the purge plugs for reinstallation by wrapping them with 3–5 turns of Teflon® tape.

4. Connect the supply of nitrogen or argon gas to the inlet purge connection or open inlet purge line. Leave the outlet connection open.
   - Exercise caution to avoid introducing dirt, moisture, rust, or other contaminants into the sensor case.
   - If the purge gas is heavier than air (such as argon), locate the inlet lower than the outlet, so the purge gas will displace air from bottom to top.
   - If the purge gas is lighter than air (such as nitrogen), locate the inlet higher than the outlet, so the purge gas will displace air from top to bottom.
5. Make sure there is a tight seal between the inlet connection and sensor case, so air cannot be drawn by suction into the case or purge line during the purging process.
6. The purge time is the amount of time required for full exchange of atmosphere to inert gas. For each sensor size, the purge time is different. Refer to Table 4. If purge lines are being used, increase the purge time to fill the additional volume of the purge line.
7. Avoid pressurizing the sensor case. At the appropriate time, shut off the gas supply, then immediately seal the purge outlet and inlet connections with the purge plugs. If pressure inside the case elevates above atmospheric pressure during operation, the flowmeter density calibration will be inaccurate.
8. Make sure the purge fitting seals are tight so air cannot be drawn by suction into the sensor case.

Table 4 Time required to purge ELITE sensor cases

Sensor model	**Purge rate** *ft³/hr (l/hr)*	**Time**(1) *minutes*
CMF010	20 (566)	1
CMF025	20 (566)	1
CMF050	20 (566)	2
CMF100	20 (566)	5
CMF200	20 (566)	12
CMF300	20 (566)	30
CMF400	20 (566)	55

(1) If purge lines are being used, increase purge time to fill the additional volume.

Rupture Disks

If the sensor has rupture disks, they are installed in the sensor purge fitting openings. The rupture disks should remain installed at all times. If you remove a rupture disk from the sensor case, it will be necessary to re-purge the case (see *Case purging procedure* on page 19).

Rupture disks are meant to vent process fluid from the sensor case in the event of a flow tube rupture. Some users connect a pipeline to the rupture disk to help contain escaping process fluid.

⚠ WARNING

High-pressure fluid escaping from the sensor can cause severe injury or death.

Pressure relief zone. Stay clear of rupture disk pressure relief area.

⚠ WARNING

Improper pressurization of a sensor case could result in serious personal injury.

Removing a rupture disk will require the sensor case to be repurged with a dry inert gas. Follow all instructions provided in the case purging procedure (see *Case purging procedure* on page 19).

For more information about rupture disks, contact Micro Motion Customer Service.

Return Policy

Micro Motion procedures must be followed when returning equipment. These procedures ensure legal compliance with government transportation agencies and help provide a safe working environment for Micro Motion employees. Failure to follow Micro Motion procedures will result in your equipment being refused delivery.

Information on return procedures and forms is available on our web support system at **www.micromotion.com**, or by phoning the Micro Motion Customer Service department (see page 2).

New and unused equipment

Only equipment that has not been removed from the original shipping package will be considered new and unused. New and unused equipment requires a completed Return Materials Authorization form.

Used equipment

All equipment that is not classified as new and unused is considered used. This equipment must be completely decontaminated and cleaned before being returned.

Used equipment must be accompanied by a completed Return Materials Authorization form and a Decontamination Statement for all process fluids that have been in contact with the equipment. If a Decontamination Statement cannot be completed (e.g., for food-grade process fluids), you must include a statement certifying decontamination and documenting all foreign substances that have come in contact with the equipment.

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